DUAL AXIS HINGE FOR HANDHELD DEVICE

PRIORITY CLAIM AND APPLICATION REFERENCE

[0001] This application claims priority under 35 U.S.C. §119 from prior provisional application Ser. No. 60/557,527, filed Mar. 30, 2004, and from prior provisional application Ser. No. 60/557,823, filed Mar. 30, 2004.

BACKGROUND OF THE INVENTION

[0002] A field of the invention is handheld devices, e.g., personal digital assistants and handsets. The invention particularly concerns handheld devices that include a hinged connection, e.g., flip style or clam shell devices.

[0003] Flip-style or clam shell devices are very popular because they form a convenient shape, and the devices have proven to be aesthetically pleasing to a large segment of the consumer market. When closed, the devices provide a small device footprint, making the storage of the device in a pocket, on a clip, in a holder, in a briefcase, in a purse, or a drawer, etc., very convenient. While the description of the devices as "flip-style" and "clam shell" may be used interchangeably, for purposes of illustration only, the device will be herein described as a "flip-style" device.

[0004] A hinge used to form a hinged connection in a handheld device, such as a flip-style device, is in a very demanding environment. Operational cycles are high frequency, meaning that users of flip-style and other hinged handheld devices open and close the device frequently. In the example of a flip-style cellular handset, a user commonly opens and closes the device with each use of the device. The hinge in a flip-style device must also provide a smooth and controlled operation, and should be biased to remain in the respective open and closed positions. There is considerable interest, however, in keeping the hinge simple and as inexpensive as possible. The handheld device market is extremely competitive, and component expenses must be kept as low as possible.

[0005] While there is a premium placed on reducing the overall size of the flip style device, there is also a need to house circuitry and other electronics within the flip style device, and as such, efficient use of the available space is desirable. However, often times, one of either the flip part or the main part of the flip style device, typically the flip part, is relegated to a relatively simple design having minimal circuitry, such as where the flip part is a dedicated keyboard or a display. One of the reasons for the simplicity of one of the typical flip part compared to a main part of a handheld device is the barrier to wired connections between the flip part and the main part presented by the hinged connection. Therefore, from a manufacturing perspective, there is a generally missed opportunity provided by the flip part to include additional electronics therein.

[0006] More specifically, the springs, cams, follower, can, device interface, locking clips, and other components of a typical hinge present a physical barrier to wiring. Wiring must be routed around the hinge and placed in a manner such that the open and close operation does not pull on the wiring. The limited number of connections available has often limited the electronic communication channels between the system electronics, e.g., processor and memories, of a main part (where they are typically housed) and the electronics in the flip part, e.g., displays, keyboards. An unattractive alternative is including another system, e.g., a processor and memory, in the flip part. The increased cost and inefficiency of that alternative is clear, and yet there is pressure to do so as the functionality of the flip style devices continues to drive the creation of increasingly complex handheld devices, which now perform functions such as capturing images and videos.

[0007] Efforts have therefore been made to route both discrete wires and flex connections circuitously around hinge components. However, the hinge is relatively small and only a limited number of cables or wires can be accommodated. A further problem is the difficulty of predicting and testing the life of a highly flexed cable assembly, which is repeatedly twisted in this manner. These approaches limit the number and type of electronics that can be placed in the flip part. Another approach is to use contact sets instead of wires. Contacts still are limited in area by the hinge, though. In addition, contacts may suffer performance problems because alignment becomes an issue. If contacts on a main part become misaligned with a flip part, for example, an adequate electric connection may not be obtained.

[0008] Other issues related to hinged connections and handheld devices include part count and assembly issues. Low part counts are desirable for manufacturing efficiencies and to reduce costs. It is also desirable that a hinge for a hinged handheld device such as a flip-style handset be self-contained and pre-assembled. This aids in the manufacturing of the handset, and also permits manufacture and assembly of components of the handset and the hinge to be conducted at separate locations and, for example, by separate vendors.

[0009] Yet another issue of concern in hinged connections of handheld devices arises when it is desirable for the flip part and main part to move relative to one another into the fully open and fully closed positions about one axis, and also rotate relative to one another about another axis such that a front portion of the flip part opposes a front portion of the main part. For example, where the flip part is a display, it may be desirable for the flip part to rotate a predetermined amount, relative to the main part, so that an operator could allow others to view the screen. Conventional hinge systems accommodate movements that include opening and closing about a main axis and rotating, to some limit of rotation, about a second axis typically perpendicular to the first axis. Conventional dual axis hinge systems typically create additional physical obstacles to circuitry and electronics, and complicate the assembly and movement of the flip device. In addition, conventional dual axis hinge systems typically limit rotation about the second axis to a single direction.

SUMMARY OF THE INVENTION

[0010] The invention provides a dual axis hinge for handheld devices. A preferred embodiment is a self-contained hinge that provides controlled rotation about two axes, e.g., perpendicular x- and y-axes. Controlled rotation about an x-axis includes fully open and closed biased positions, and also preferably provides self-open and/or self-close assistance when predetermined rotational points about the x-axis are reached. Controlled rotation about a y-axis provides a